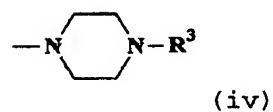
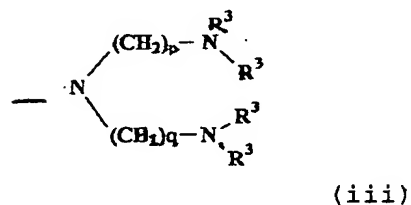
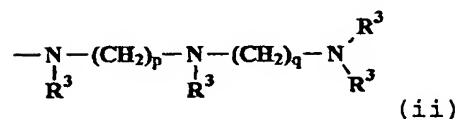
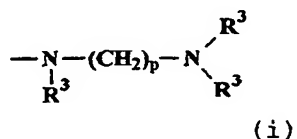


## CLAIMS

What is claimed is:

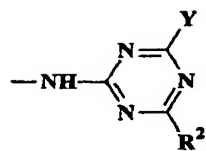
1. A colorant in an ink jet ink formulation, the colorant comprising an organic dye chromophore with at least one functional group Y containing one or more primary, secondary or tertiary amino groups, which in the presence of an acid provides a water soluble, cationic ink jet ink colorant with increased water fastness when applied to paper.
2. The colorant of claim 1, further comprising a linking group, X, between the organic chromophore and the amino functional group, Y.
3. The colorant of claim 2, comprising between 1 to 4 functional groups, Y, as side chains or attached to side chains.
4. The colorant of claim 3, wherein the organic dye chromophore is selected from the group consisting of azo, bisazo, hydrazone, anthraquinone, styryl, methine, triphenylmethane, xanthene, including rhodamines, zinc phthalocyanine, copper phthalocyanine, benzopyranobenzimidazopyridine derivative, oxazinium, phenothiazinium, phthalocyanine, porphyrin, coumarin, naphthalimide, perylene, squaraine, cyanine, azacarbocyanine, hemicyanine, diethylaminepropylamine, methylpiperazine, and diazahemicyanine chromophores.

5. The colorant of claim 3, wherein Y comprises one to three primary, secondary or tertiary amino groups and Y is selected from the group consisting of:



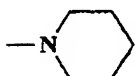
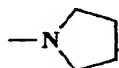
where  $R^3$  is, same or different, H, methyl, ethyl or  $-\text{CH}_2\text{CH}_2\text{OH}$ ; and p and q are 2, 3 or 4.

6. The colorant of claim 5, wherein the linking group, X is selected from the group consisting of:  $-\text{SO}_2-$ ;  $-\text{CO}-$ ;  $-\text{NR}^1(\text{CH}_2)_m-$ , where  $R^1$  is H, Me, Et, n-Pr, n-Bu,  $-\text{CH}_2\text{CH}_2\text{OH}$ , and  $-(\text{CH}_2)_m\text{Y}$ , and  $m=2$  or 3;  $-\text{CH}_2$ ; and



where  $R^2$  is  $-OH$ ,  $-OMe$ ,  $-OEt$ ,  $-Cl$ ,  $-NH_2$ ,  $-NHMe$ ,  $-NHEt$ ,  $-NMe_2$ ,  $-NEt_2$ ,  $-NHCH_2CH_2OH$ ,  $-NHPh$ ,  $-N(CH_2CH_2OH)_2$  or  $Y$ .

7. The colorant of claim 6, wherein in the case of  $X=-CH_2$ ,  $Y$  is selected from (i)-(iv) above and



$-NR^4R^5$ , where  $R^4$  and  $R^5$  is same or different and any of  $H$ ,  $Me$ ,  $Et$ ,  $n-Pr$ ,  $n-Bu$ ,  $-CH_2CH_2OH$ .

8. The colorant of claim 1, wherein the ink formulation is a black fluorescent ink formulation for postal applications.

9. The colorant of claim 8, comprising a phosphor meter reading of about 46.

10. The colorant of claim 9, wherein the ink formulation has a viscosity of about 3 cps.

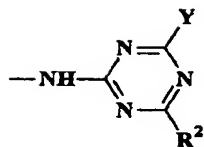
11. The colorant of claim 10, wherein the ink formulation has a surface tension of about 38.8 dynes/cm.

12. The colorant of claim 1, wherein the acid is selected from group consisting of: formic, acetic, glycolic, lactic, levulinic, gluconic, glucuronic, trifluoroacetic, nitric, hydrochloric, phosphoric, sulphuric acids, and combinations thereof.

13. A colorant in an ink jet ink formulation, the colorant comprising an organic dye chromophore with at least one functional group Y containing one or more primary, secondary or tertiary amino groups, attached by a linking group X, which in the presence of an acid provides a water soluble, cationic ink jet ink colorant with increased water fastness when applied to paper, wherein the colorant includes a water-insoluble amino-substituted dye of formula (I): [Chromophore]-[X-Y]<sub>n</sub>, where n=1-4 side chains of [X-Y], in the colorant.

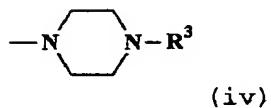
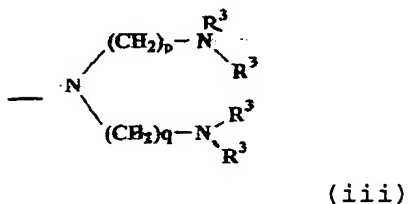
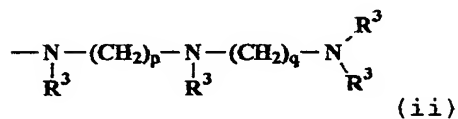
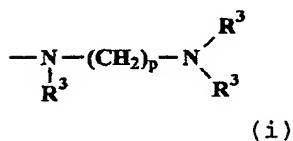
14. The colorant of claim 1, wherein the ink jet ink formulation is a fluorescent ink jet ink formulation.

15. The colorant of claim 13, wherein X is selected from the group consisting of: -SO<sub>2</sub>-; -CO-; -NR<sup>1</sup>(CH<sub>2</sub>)<sub>m</sub>-, where R<sup>1</sup> is H, Me, Et, n-Pr, n-Bu, -CH<sub>2</sub>CH<sub>2</sub>OH, and -(CH<sub>2</sub>)<sub>m</sub>Y, and m=2 or 3; -CH<sub>2</sub>; and

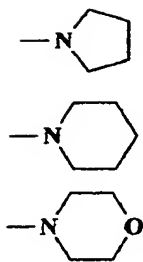


where  $\text{R}^2$  is  $-\text{OH}$ ,  $-\text{OMe}$ ,  $-\text{OEt}$ ,  $-\text{Cl}$ ,  $-\text{NH}_2$ ,  $-\text{NHMe}$ ,  $-\text{NHEt}$ ,  $-\text{NMe}_2$ ,  $-\text{NEt}_2$ ,  $-\text{NHCH}_2\text{CH}_2\text{OH}$ ,  $-\text{NHPh}$ ,  $-\text{N}(\text{CH}_2\text{CH}_2\text{OH})_2$  or  $\text{Y}$ .

16. The colorant of claim 15, wherein  $\text{Y}$  is selected from the group consisting of:



where  $\text{R}^3$  is, same or different,  $\text{H}$ , methyl, ethyl or  $-\text{CH}_2\text{CH}_2\text{OH}$  and  $p$  and  $q$  are 2, 3 or 4; and in the case of  $\text{X} = -\text{CH}_2$ ,  $\text{Y}$  is selected from the group consisting of (i)-(iv) and:



-NR<sup>4</sup>R<sup>5</sup>, where R<sup>4</sup> and R<sup>5</sup> is same or different and any of H, Me, Et, n-Pr, n-Bu, -CH<sub>2</sub>CH<sub>2</sub>OH.

17. The colorant of claim 16, wherein the ink formulation is a black fluorescent ink formulation for postal applications.

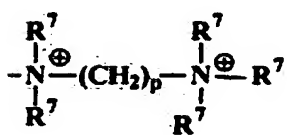
18. A colorant in an ink jet ink formulation, the colorant comprising an organic dye chromophore having at least two positive charges provided by one or more attached functional groups, Q, each containing one or more cationic quaternary ammonium groups, which provide a water soluble, cationic ink jet ink colorant, having increased water fastness when applied to paper.

19. The colorant of claim 18, further comprising a linking group, P, between the organic chromophore and the quaternary ammonium bearing functional group, Q.

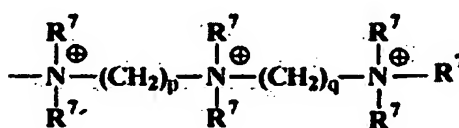
20. The colorant of claim 19, comprising between 1 to 4 side chains of the functional group, Q.

21. The colorant of claim 18, wherein the organic dye chromophore is selected from the group consisting of azo, bisazo, hydrazone, anthraquinone, styryl, methine, triphenylmethane, xanthene, including rhodamines, zinc phthalocyanine, copper phthalocyanine, benzopyranobenzimidazopyridine derivative, oxazinium, phenothiazinium, phthalocyanine, porphyrin, coumarin, naphthalimide, perylene, squaraine, cyanine, azacarbocyanine, hemicyanine, diethylaminepropylamine, methylpiperazine, and diazahemicyanine chromophores.

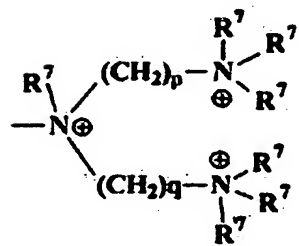
22. The colorant of claim 20, wherein Q is selected from the group consisting of:



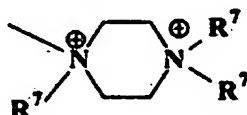
(vi)



(vii)

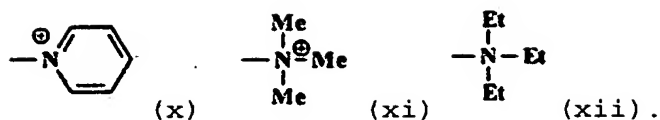


(viii)



(ix)

where  $\text{R}^7$  is any of the same or different of Me, Et, n-Pr, n-Bu or  $-(\text{CH}_2\text{CH}_2)_H$ , and p and q are 2, 3 or 4; and where P is  $-\text{CH}_2$  or  $-\text{NR}^6(\text{CH}_2)_m$ , with  $\text{R}^6$  as defined above and m = 2 or 3, additional structures for Q include (x)-(xii):



23. The colorant of claim 22, wherein the linking group, P, is selected from the group consisting of  $-\text{SO}_2-$ ;  $-\text{CO}-$ ;  $-\text{CH}_2-$ ; and  $-\text{NR}^6(\text{CH}_2)_m-$ , where  $\text{R}^6$  is H, Me, Et, n-Pr, n-Bu,  $-\text{CH}_2\text{CH}_2\text{OH}$ , or  $-(\text{CH}_2)_m\text{Q}$  and m is 2 or 3.

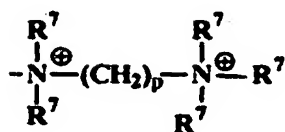
24. The colorant of claim 18, wherein the ink jet ink formulation is a fluorescent ink formulation.

25. A colorant in an ink jet ink formulation, the colorant comprising an organic dye chromophore having at least two positive charges provided by one or more attached functional groups, Q, each containing one or more cationic quaternary ammonium groups, which provide a water soluble, cationic ink jet ink colorant, having increased water fastness when applied to paper, wherein a linking group, P, is located between the organic chromophore and the functional group, Q, and the colorant is represented by formula (II):  $[\text{Chromophore}]-[\text{P-Q}]_n$ , where n=1-4 side chains of  $[\text{P-Q}]$ , in the colorant.

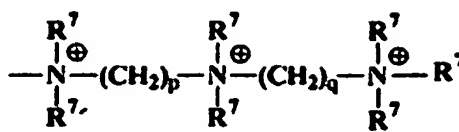
26. The colorant of claim 25, wherein P is selected from the group consisting of  $-\text{SO}_2-$ ;  $-\text{CO}-$ ;  $-\text{CH}_2-$ ; and  $-\text{NR}^6(\text{CH}_2)_m-$ , where  $\text{R}^6$  is H, Me, Et, n-Pr, n-Bu,  $-\text{CH}_2\text{CH}_2\text{OH}$ , or  $-(\text{CH}_2)_m\text{Q}$  and m is 2 or 3.



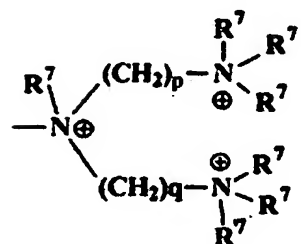
27. The colorant of claim 26, wherein Q is selected from the group consisting of:



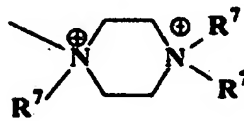
(vi)



(vii)

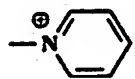


(viii)

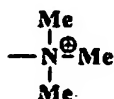


(ix)

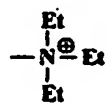
where  $\text{R}^7$  is any of the same or different of Me, Et, n-Pr, n-Bu or  $-(\text{CH}_2\text{CH}_2)\text{H}$ , and p and q are 2, 3 or 4; and where P is  $-\text{CH}_2$  or  $-\text{NR}^6(\text{CH}_2)_m-$ , with  $\text{R}^6$  as defined above and m = 2 or 3, additional structures for Q include (x) - (xii):



(x)



(xi)



(xii).

28. The colorant of claim 18, wherein Q comprises at least two cationic quaternary functional groups.

29. The colorant of claim 25, wherein Q comprises at least two cationic quaternary functional groups.

30. A fluorescent ink jet printing ink formulation comprising the colorant of claim 7, water and an organic solvent mixed together to form the fluorescent ink jet printing ink formulation.

31. A fluorescent ink jet printing ink formulation comprising the colorant of claim 22, water and an organic solvent mixed together to form the fluorescent ink jet printing ink formulation.

32. A homogeneous aqueous ink formulation comprising:

a) a first colorant comprising at least one fluorescent dye;

b) a second colorant comprising the colorant of claim 7;  
and

c) an aqueous liquid vehicle comprising water and an organic solvent;

wherein the ink formulation has an ink viscosity and surface tension effective for application of the ink to a cellulose substrate in a predetermined pattern by ink jet printing.

33. The homogeneous aqueous ink formulation of claim 32, wherein the ink is a black fluorescent ink for postal applications.

34. A homogeneous aqueous ink formulation comprising:

- a) a first colorant comprising at least one fluorescent dye;
- b) a second colorant comprising the colorant of claim 22; and
- c) an aqueous liquid vehicle comprising water and an organic solvent;

wherein the ink formulation has an ink viscosity and surface tension effective for application of the ink to a cellulose substrate in a predetermined pattern by ink jet printing.

35. The homogeneous ink formulation of claim 34, wherein the ink is a black fluorescent ink for postal applications.

36. A homogeneous aqueous black fluorescent ink formulation comprising:

- a) a first colorant comprising at least one fluorescent dye;
- b) a second colorant comprising the colorant of claim 1; and
- c) an aqueous liquid vehicle comprising water and an organic solvent;

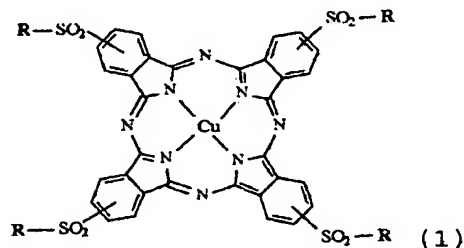
wherein the homogeneous aqueous black fluorescent ink formulation has an ink viscosity and surface tension effective for application of the ink to a cellulose substrate in a predetermined pattern by ink jet printing.

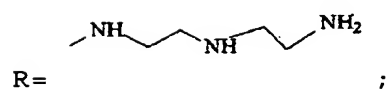
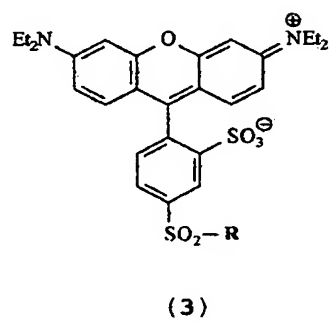
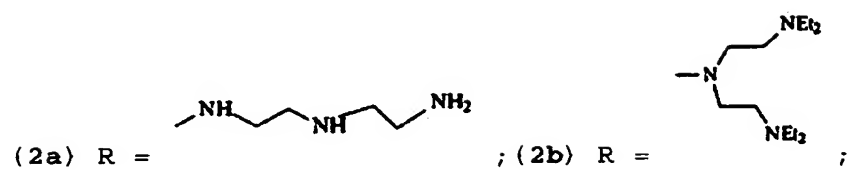
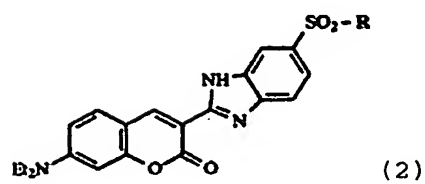
37. A homogeneous aqueous black fluorescent ink formulation comprising:

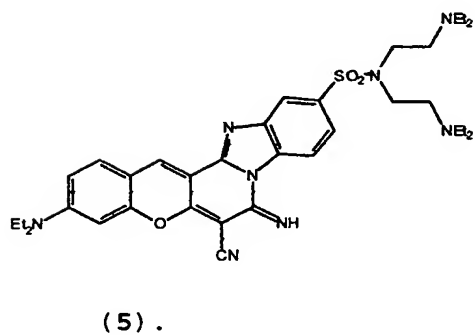
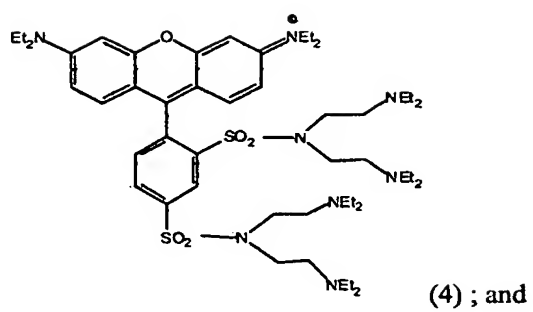
- a) a first colorant comprising at least one fluorescent dye;
- b) a second colorant comprising the colorant of claim 18; and
- c) an aqueous liquid vehicle comprising water and an organic solvent;

wherein the homogeneous black fluorescent ink formulation has an ink viscosity and surface tension effective for application of the ink to a cellulose substrate in a predetermined pattern by ink jet printing.

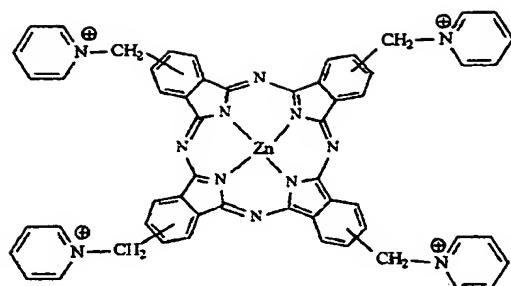
38. The colorant of claim 4 comprising a compound selected from the group consisting of (1)-(5):







39. The colorant of claim 21 comprising a compound selected from the group consisting of (6) - (10):



(6) ;

